

**CLAIMS**

1. A pumping arrangement for pumping multi-phase fluid flow said arrangement comprising:

5 a centrifugal pump which includes a fluid inlet and an outlet and driveable by a power providing means,

10 a fluid communication providing means to provide a communication of fluid between said outlet and said inlet of said pump, said fluid communication being such as to provide a fluid connection between said outlet and said inlet to deliver fluid of a higher pressure from said outlet to said inlet when said centrifugal pump is in operation,

15 wherein said centrifugal pump is provided with an impeller which has a plurality of vanes configured to define there between larger passageways when compared to a conventional centrifugal pump which would operate in or near optimum conditions when pumping liquid only.

20 2. A Pumping arrangement as claimed in claim 1 wherein said arrangement is for pumping a fluid of a gaseous/liquid mix.

25 3. A Pumping arrangement as claimed in claims 1 or 2 wherein said power providing means is an electric motor.

4. A Pumping arrangement as claimed in any one of claims 1 to 3 wherein said fluid connection is a bleed line to bleed a portion of said fluid from the outlet of said centrifugal pump to the inlet.

5. A Pumping arrangement as claimed in any one of claims 1 to 4 wherein said fluid connection between said outlet and inlet of said centrifugal pump is provided with at least one nozzle at the inlet for injection of bled fluid into the delivery line of said inlet of said centrifugal pump.

20 6. A Pumping arrangement as claimed in claim 5 wherein said at least one nozzle provides, an increase in velocity head to said bled flow prior to the point of injection by reducing the flow area of the fluid connection means

30 7. A Pumping arrangement as claimed in claims 5 or 6 wherein said at least one nozzle is oriented in respect of the delivery line of the inlet so as to impart a pre-rotation force onto the main inlet side fluid delivery.

8. A Pumping arrangement as claimed in claim 7 wherein said pre-rotation is in a direction co-rotatory with said impeller rotation direction.

5  9. A Pumping arrangement as claimed in any one of claims 1 to 8 wherein said impeller is not of a substantially greater diameter than said conventional pump.

10  10. A Pumping arrangement as claimed in any one of claims 1 to 9 wherein the impeller is one modified from a one of a centrifugal pump which would be ordinarily (to operate at or about peak efficiency) designated to pump in a similar situation to the pump of the present invention but where the fluid is liquid only, said modification including the removal of vanes to provide said larger passageways, but to a limit of no less than 2 vanes remaining present.

11. A Pumping arrangement as claimed in any one of claims 1 to 10 wherein said impeller has between 2 and 4 vanes.

12. A Pumping arrangement as claimed in any one of claims 1 to 11 wherein said impeller has 4 vanes.

13. A method of pumping multi-phase fluid flow said arrangement comprising:  
15  providing a centrifugal pump which includes a fluid inlet connected in fluid communication with a fluid source and an outlet through which said fluid is delivered, providing a power providing means to rotate the impeller of said centrifugal pump

20  bleeding a portion of fluid from the outlet and delivering the bled fluid via a fluid connection providing means to said inlet to be injected into the main fluid flow into said centrifugal pump fluid,

25  wherein said centrifugal pump is provided with an impeller which has a plurality of vanes configured to define there between larger passageways when compared to a conventional centrifugal pump which would operate in or near optimum conditions when pumping liquid only.

14. A method of pumping as claimed in claim 13 wherein said method further includes providing a flow control means in said fluid connection providing means to allow the rate of bled fluid flow to be controlled.

30  15. A method of pumping as claimed in claims 13 or 14 wherein said method further includes the provision of a means to measure the volumetric rate and head of pressure of delivered fluid, the measurements taken to be utilised in setting of the flow control means.

16. A method of pumping as claimed in any one of claims 13 to 15 wherein said bleeding includes prior to the injection of said fluid, the splitting of fluid into at least

two separated flow paths, wherein for each flow path there is an injection nozzle provided to inject the flow into the main suction flow to said centrifugal pump.

17. A method of pumping as claimed in any one of claims 13 to 16 wherein said injection of said bled fluid is in a manner which induces a rotation onto the main suction flow of fluid.

18. A method of pumping as claimed in claim 17 wherein said rotation is in a direction co-rotatory with the direction of rotation of the impeller.

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